Co-control of Air Pollutants and GHGs: Why and How

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• Low carbon
  – PV Panel production in Baoding – a low carbon demo city
    • Low carbon and clean in using process
    • Energy intensive production process with air pollution emissions
  – CCS (carbon capture and storage) in China Resources, Tianjin Demo Project

• Low air pollutants
  – FGD (flue-gas desulfurization)
  – SCR (selective catalytic removal)
## Emission effectiveness by counter-benefits control measures in power sector

<table>
<thead>
<tr>
<th>Power Sector Control Measures</th>
<th>Emission Effectiveness (t)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>SO₂</td>
</tr>
<tr>
<td>FGD</td>
<td>-1</td>
</tr>
<tr>
<td>SCR (Selective Catalytic Removal)</td>
<td>+0.006</td>
</tr>
<tr>
<td>CCS</td>
<td>+0.0013</td>
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</tbody>
</table>
Theoretical question: what are the relationships among emissions?

WGI: Atmosphere

WGII: Impacts

WG III: Emissions

CO, CO₂, SO₂, NOₓ, BC, PM, Hg
Review of co-benefit development

- **Stage 1 Ancillary/Secondary Benefits Period**
  (After 1997 when Kyoto Protocol signed)
  - Awareness of Air pollution reductions, as ancillary benefits or secondary benefits of GHGs reduction
    - China and US reluctant
  - **But**
    - Two-way impacts
    - Counter-benefits (dis-benefits)
Review of co-benefit development

- **Stage 2 Co-benefits Period (IPCC 3)**
  - Realization of two way impact—local pollution and GHGs are mutually linked to each other and efforts are made to measure co-benefits
    - China and US each receptive to this concept
    - US EPA-SEPA-Tsinghua IES cooperation
  - But,
    - Counter-benefits
    - Maximization of co-benefits
Review of co-benefit development

• Stage 3 Co-control Period (from 2006)
  – Co-control policies/programs/projects are designed and proposed in order to maximize co-benefits
    • 11th FYP set SO₂ and CO₂ targets together
    • 12th FYP add NOx
    • MEP’s new program “Regional cooperative air quality control and multi-pollutants control
    • MEP’s new ambient air quality index (AQI) standards
      – Pm2.5
      – Ground Ozone
How Co-control

One stone kills two birds!
Western Vs Oriental medicines
How Co-control

• Two Principles
  – Physical synergy: necessity condition
    • Relationship between emissions
      – Why preventing first?
  – Economic cost-benefit/effective: feasibility condition
    • How feasible of control measure/plan/policy in market?
      – Air pollutants equivalents (Apeq) based on social welfare loss equivalent of CO2, SO2, NOx etc emissions
How Co-control

• Methodology
  – A methodology of co-control is developed and has been applied in power sector as a demonstration, including
    • Definition of co-control
    • Evaluation of control measures /project/plan/policy/program
    • Selection, design and planning of co-control measures/project/plan/program/policy
    • Policy instrument and intuitional support
      – Adjust policy to let co-control economically feasible
4 Indicators for Evaluating Co-control Measures/Plan/Policy

<table>
<thead>
<tr>
<th></th>
<th>Absolute</th>
<th>Relative</th>
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<tbody>
<tr>
<td>Physical</td>
<td>Ratio between pollutants reductions</td>
<td>Elasticity of pollutants reductions</td>
</tr>
<tr>
<td>Economic</td>
<td>Reduction cost per unit of Apeq</td>
<td>Apeq Elasticity of cost</td>
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## Ratio between pollutants reductions

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<tbody>
<tr>
<td></td>
<td>SO₂</td>
<td>NOx</td>
</tr>
<tr>
<td>FGD</td>
<td>1.59</td>
<td>-1</td>
</tr>
<tr>
<td>Selective Catalytic Reduction</td>
<td>0.64</td>
<td>+0.006</td>
</tr>
<tr>
<td>CCS</td>
<td>0.08</td>
<td>+0.0013</td>
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Elasticity of pollutants reductions

<table>
<thead>
<tr>
<th>Control Measures</th>
<th>$\text{El}_{c/s}$</th>
<th>$\text{El}_{s/c}$</th>
<th>$\text{El}_{c/n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGD</td>
<td>-0.02</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SCR</td>
<td>—</td>
<td>—</td>
<td>-0.01</td>
</tr>
<tr>
<td>CCS</td>
<td>—</td>
<td>-0.33</td>
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### Abatement Cost of Control Measures

<table>
<thead>
<tr>
<th></th>
<th>SO₂</th>
<th>NOₓ</th>
<th>CO₂</th>
<th>Apeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>FGD</td>
<td>0.14</td>
<td>-0.002</td>
<td>-0.75</td>
<td>0.12</td>
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<tr>
<td>SCR</td>
<td>-0.001</td>
<td>0.10</td>
<td>-0.19</td>
<td>0.10</td>
</tr>
<tr>
<td>CCS</td>
<td>-0.003</td>
<td>-0.002</td>
<td>2.14</td>
<td>0.04</td>
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</table>
APeq Elasticity of abatement cost

If you increase investment by 1% what is the % change of pollutants

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<tr>
<td><strong>FGD</strong></td>
<td>0.47</td>
</tr>
<tr>
<td><strong>SCR</strong></td>
<td>0.37</td>
</tr>
<tr>
<td><strong>CCS</strong></td>
<td>0.15</td>
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Next step

• Pilot Co-control implementation at city/regional level, under the MEP’s Program “Cooperative regional air quality control and co-control of multi-pollutants”
  – Developing guideline for co-control implementation in sectors and regions
  – Expand to measure other linkages (climate-pollution-water nexus)
  – Co-control policy instruments to enable co-control program
  – Co-control institutional reform to support co-control program
Next step

- Revising Clean Air Act with co-control concept by NPC
- Studying on Co-control Program in 13th FYP for achieving the New Ambient AQI Standards, and Total Emissions Control (TEC) of APeq
Thanks!